WHAT IS CLAIMED IS:

1. A siloxane-based resin prepared by hydrolyzing and condensing a silane-based monomer having the structure of Formula 1, and at least one monomer selected from the group consisting of compounds of Formulas 2 to 4, in an organic solvent in the presence of an acid or alkaline catalyst and water:

Formula 1

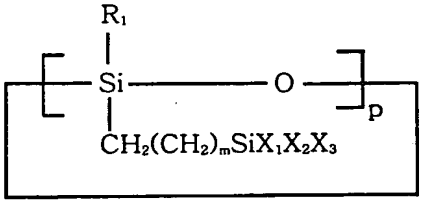
$Si[(CH_2)_kSiY_1Y_2Y_3]_4$

wherein,

k is an integer of 1-10; and

Y_1, Y_2 and Y_3 are independently a C_1-C_3 alkyl group, a C_1-C_{10} alkoxy group, or a halogen atom, provided that at least one of them is hydrolyzable,

Formula 2



wherein,

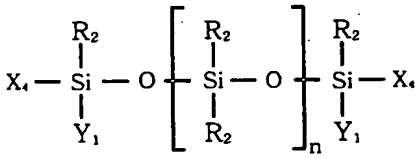
R_1 is a C_1-C_3 alkyl group, or a C_6-C_{15} aryl group;

X_1, X_2 and X_3 are independently a hydrogen atom, a C_1-C_3 alkyl group, a C_1-C_{10} alkoxy group, or a halogen atom, provided that at least one of them is hydrolyzable;

m is an integer of 0-10; and

p is an integer of 3-8,

Formula 3



wherein,

R_2 is a C_1-C_3 alkyl group, or a C_6-C_{15} aryl group;

X_4 is a hydrogen atom, or a C_1-C_{10} alkoxy group;

Y_1 is a hydrogen atom, a C_1-C_3 alkyl group or a C_1-C_{10} alkoxy group; and

n is an integer of 0-10, and

Formula 4

$R_3Si(X_5X_6X_7)_3$

wherein,

R_3 is a C_1-C_3 alkyl group, or a C_6-C_{15} aryl group;

X_5, X_6 and X_7 are independently a hydrogen atom, a C_1-C_3 alkyl group, a C_1-C_{10} alkoxy group, or a halogen atom, provided that at least one of them is hydrolyzable.

2. The siloxane-based resin according to claim 1, wherein the molar ratio of the monomer of Formula 1 to the monomer selected from the group consisting of compounds of Formulas 2 to 4 is 1:99 to 99:1.

3. The siloxane-based resin according to claim 1, wherein the catalyst is selected from the group consisting of hydrochloric acid, nitric acid, benzene sulfonic acid, oxalic acid, formic acid, potassium hydroxide, sodium hydroxide, triethylamine, sodium bicarbonate, pyridine, and mixtures thereof.

4. The siloxane-based resin according to claim 1, wherein the molar ratio of the monomer to the catalyst is 1:0.000001 to 1:10.

5. The siloxane-based resin according to claim 1, wherein the molar ratio of the monomer to water is 1:1 to 1:1000.

6. The siloxane-based resin according to claim 1, wherein the hydrolysis and condensation reactions are performed at 0-200°C for 0.1-100 hours.

7. The siloxane-based resin according to claim 1, wherein the organic solvent is selected from the group consisting of an aliphatic hydrocarbon solvent, an aromatic hydrocarbon solvent, a ketone-based solvent, an ether-based solvent, an acetate-based solvent, an alcohol-based solvent, an amide-based solvent, a silicon-based solvent, and mixtures thereof.

8. The siloxane-based resin according to claim 1, wherein the weight average molecular weight of the resin is 3,000 to 300,000.

9. A method of preparing a semiconductor interlayer insulating film which comprises:

providing a liquid coating composition by dissolving the siloxane-based resin according to claim 1 in an organic solvent;

coating a silicon wafer with the liquid coating composition to form a coating film; and

heat-curing the coating film.

10. The method according to claim 9, wherein the siloxane-based resin is mixed with a porogen so that the weight ratio of the resin to the porogen is 99:1-30:70.

11. The method according to claim 10, wherein the porogen is selected from the group consisting of cyclodextrin, polycaprolactone and derivatives thereof.

12. The method according to claim 9, wherein the organic solvent is selected from the group consisting of an aliphatic hydrocarbon solvent, an aromatic hydrocarbon solvent, a ketone-based solvent, an ether-based solvent, an acetate-based solvent, an alcohol-based solvent, an amide-based solvent, a silicon-based solvent, and mixture thereof.

13. The method according to claim 9, wherein the weight ratio of solid component containing the siloxane-based resin and the porogen is 5-70 wt% based on the total weight of the composition.

14. The method according to claim 9, wherein the liquid coating composition is applied to the silicon wafer through spin coating.

15. The method according to claim 9, wherein the heat curing is performed at a temperature of 150-600°C for 1-150 min.

16. A semiconductor interlayer insulating film, comprising the siloxane-based resin of claim 1.

17. The semiconductor interlayer insulating film according to claim 16, wherein micropores are formed throughout the film by the use of a porogen.

18. The semiconductor interlayer insulating film according to claim 17, wherein the porogen is selected from the group consisting of cyclodextrin, polycaprolactone and derivatives thereof.

19. A siloxane-based resin comprising the reaction product of a silane-based monomer having the structure of Formula 1 and at least one monomer selected from the group consisting of compounds of Formulas 2 to 4, wherein,

Formula 1

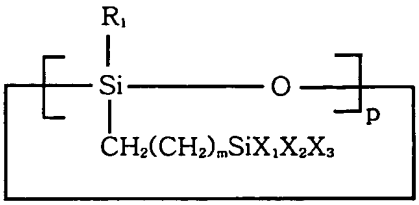
$Si[(CH_2)_kSiY_1Y_2Y_3]_4$

wherein,

k is an integer of 1-10; and

Y_1, Y_2 and Y_3 are independently a C_1-C_3 alkyl group, a C_1-C_{10} alkoxy group, or a halogen atom, provided that at least one of them is hydrolyzable,

Formula 2



wherein,

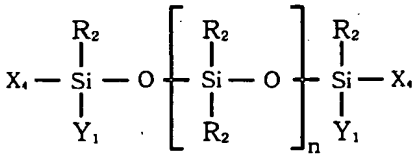
R_1 is a C_1-C_3 alkyl group, or a C_6-C_{15} aryl group;

X_1, X_2 and X_3 are independently a hydrogen atom, a C_1-C_3 alkyl group, a C_1-C_{10} alkoxy group, or a halogen atom, provided that at least one of them is hydrolyzable;

m is an integer of 0-10; and

p is an integer of 3-8,

Formula 3



wherein,

R_2 is a C_1-C_3 alkyl group, or a C_6-C_{15} aryl group;

X_4 is a hydrogen atom, or a C_1-C_{10} alkoxy group;

Y_1 is a hydrogen atom, a C_1-C_3 alkyl group or a C_1-C_{10} alkoxy group; and

n is an integer of 0-10, and

Formula 4

$R_3Si(X_5X_6X_7)_3$

wherein,

R_3 is a C_1-C_3 alkyl group, or a C_6-C_{15} aryl group;

X_5, X_6 and X_7 are independently a hydrogen atom, a C_1-C_3 alkyl group, a C_1-C_{10} alkoxy group, or a halogen atom, provided that at least one of them is hydrolyzable.

20. A semiconductor interlayer insulating film comprising the siloxane-based resin of claim 19.